

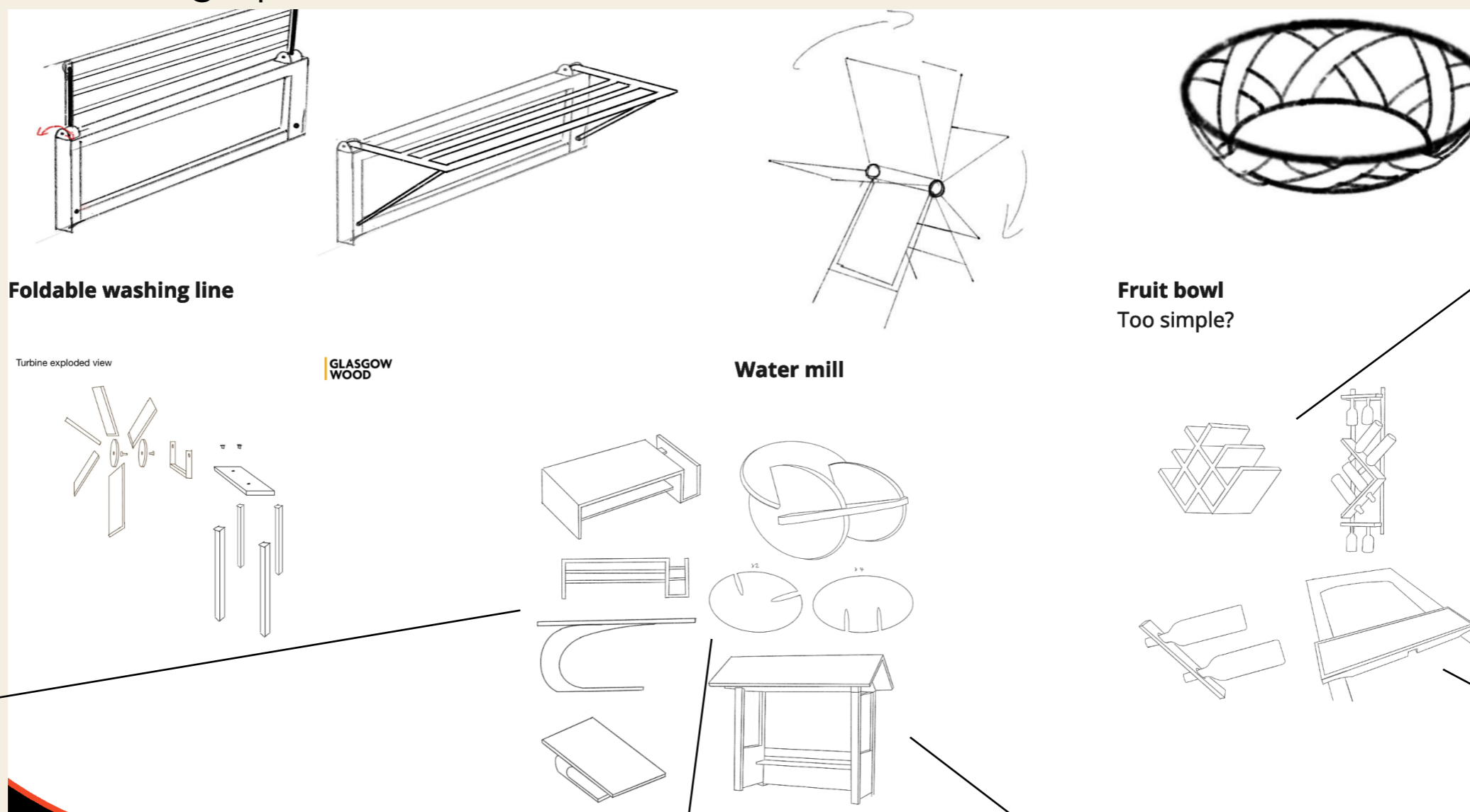
PDE 3 PORTFOLIO

Kai Porter

Glasgow Wood 1 - Initial Ideas

For this project, we were working with a local company called Glasgow Wood. They take in scrap wood and turn it into different pieces, such as indoor and outdoor furniture and other household items. We are designing a product for Glasgow Wood to produce.

1. We first started coming up with some different initial ideas.



To stick with their existing products of furniture I designed these 2 types of coffee tables that are less traditional than what you normally see.

With the chair, I thought it was a simple piece that works well and only uses 2 different pieces.

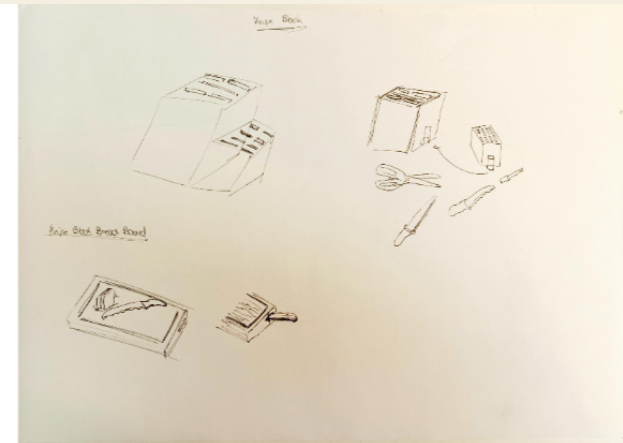
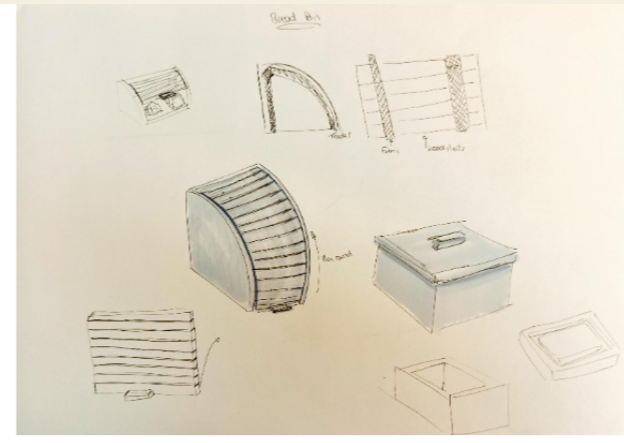
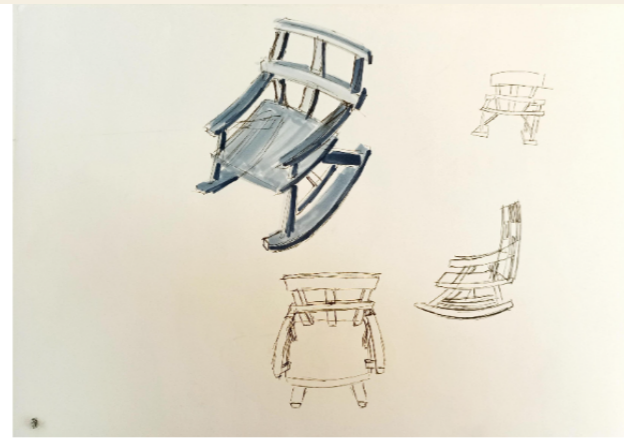
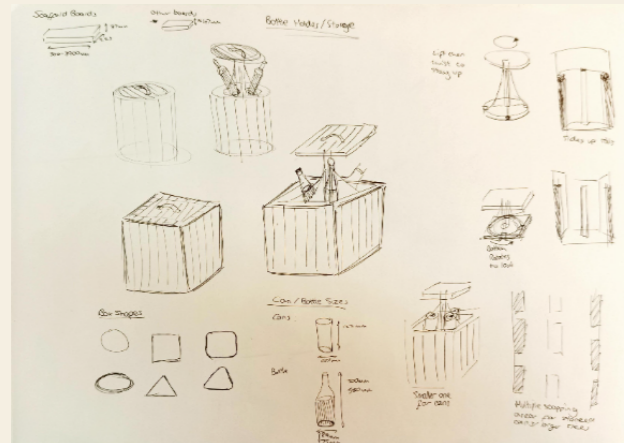
This is a wooden bus stop that could be placed in places where there aren't shelters.

The different wine racks were designed something that they hadn't done before so they could reach a wider market.

This was to over a bathtub so you would be able to put items on it,

Glasgow Wood 2 - Initial Ideas

All of these pages are other initial ideas that have been done by my other team members.



Concept 1: Turbine

GLASGOW WOOD

- educating school children on wind power
- Could be placed in schools as a educational tool

Concept 2: Mirror

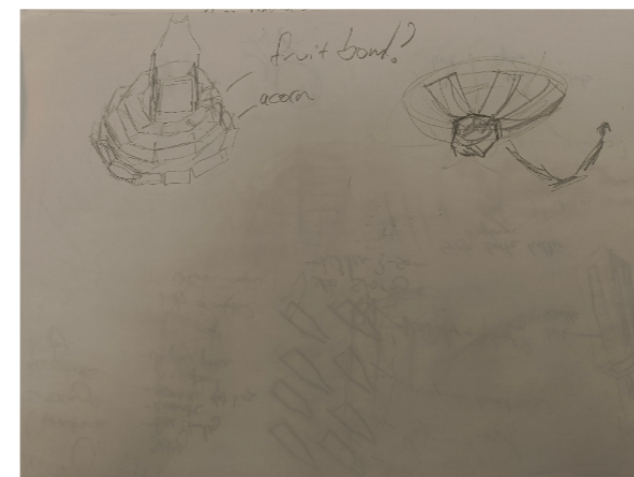
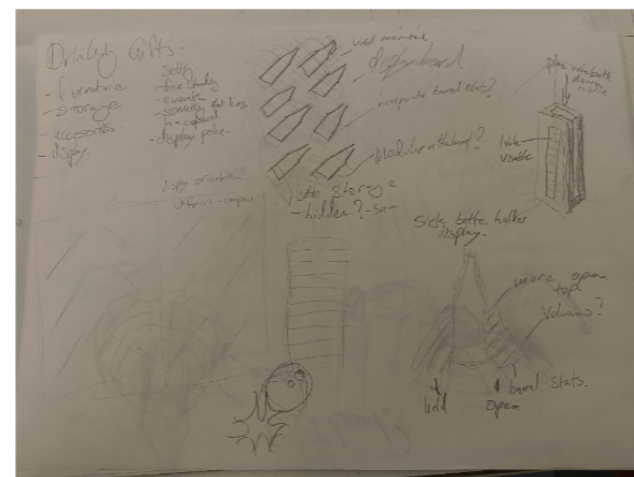
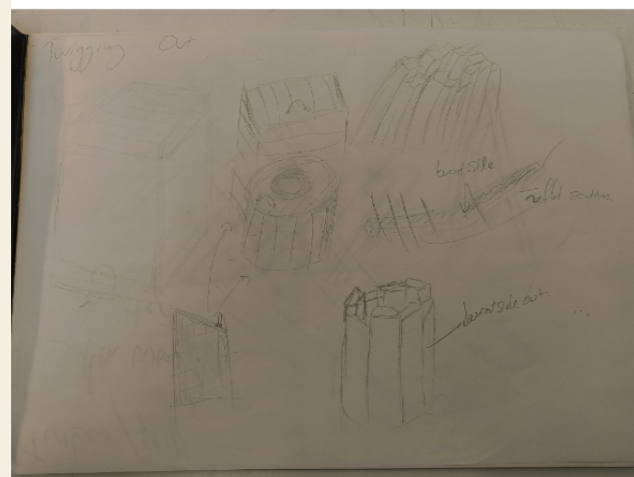
GLASGOW WOOD

Concept 3: Bench

GLASGOW WOOD

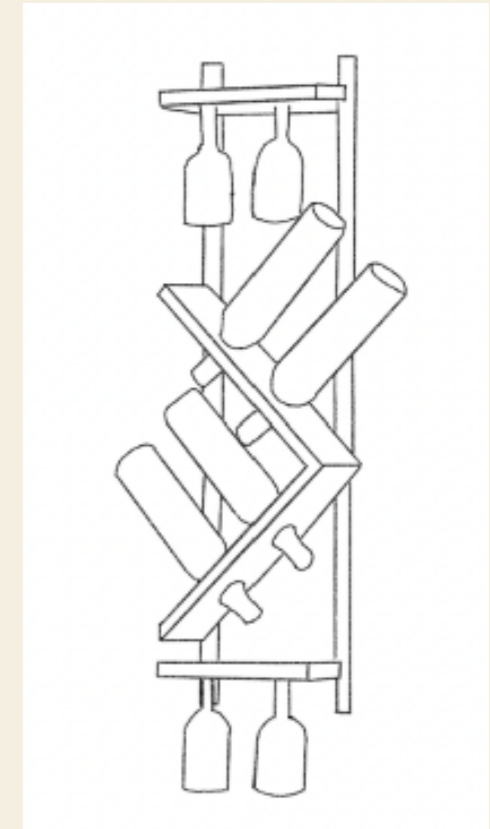
Bench made from recycled whisky barrel

Flower bed bench



Glasgow Wood 3 - Chosen Products

2. We chose these as our three chosen products as they were all different products that they don't produce and are the most interesting to our group.



3. We got feedback from our classmates for our 3 different ideas.

Windmill

- The windmill would need to be balanced with the weight distributed well.
- The windmill would have to be health and safety-regulated.
- 5mm is the smallest Glasgow wood that could have a piece of wood for the mill's blade.

Fruit Bowl

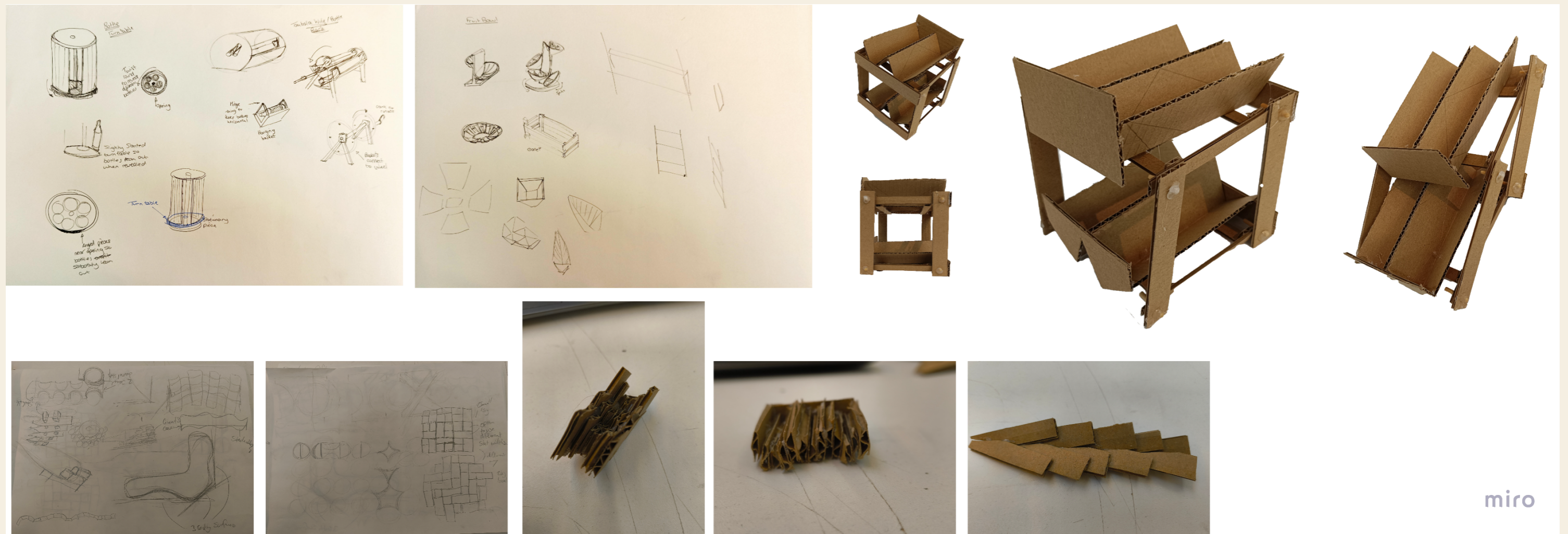
- Very simple object - lots of scope to make interesting forms.
- Needs to be food safe - refined finish, might have complex small joints that aren't easy for volunteers to make.

Dynamic Wine Rack

- What is the purpose of the movement - need to justify extra complexity.

Glasgow Wood 5 - Initial Wine Rack Ideas

Here are more of my group's initial ideas for the wine rack.

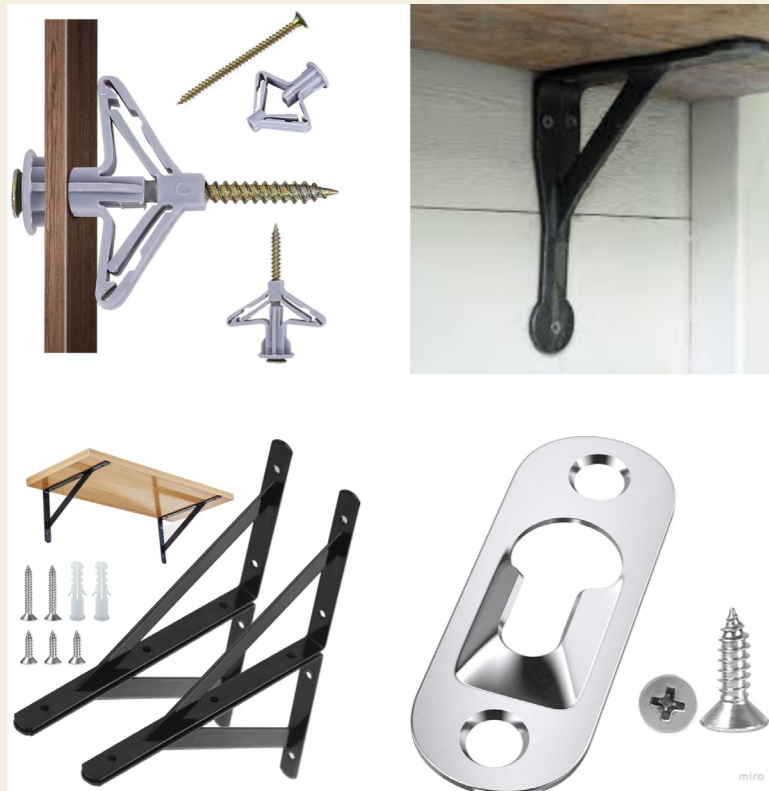


During concept development, we were looking at a dynamic wine rack and a modular wine rack. The dynamic one would have a mechanism that would open like a toolbox, and the modular static one could be buildable to how many wine bottles someone needs. This helped us test and get feedback on what would work well and what wouldn't and we found that having a dynamic wine rack wouldn't benefit the product that much.

Glasgow Wood 6 - Research

5. We then decided to move forward with a static modular wine rack was the best option for us. Having discussed the technicality of having a mechanism in a wooden structure it was a negative. We also found our group was thrilled with the style of the modular design we had developed and for this project, it felt like the right fit going forward.

We started to do some research into how to mount it to the wall and some market research.



Deciding on how we were going to wall mount our structure was proving to be a challenge at this point of the design process and we felt that our interim talk with Glasgow Wood would provide the necessary insight on how to move forward.

Why did we go forward with a wine rack?

As a team, we felt it is a handy piece of furniture that most people have in their homes but it is often the same and we felt we could recreate what a wine rack is and can be.

Why is it designed the way it is?

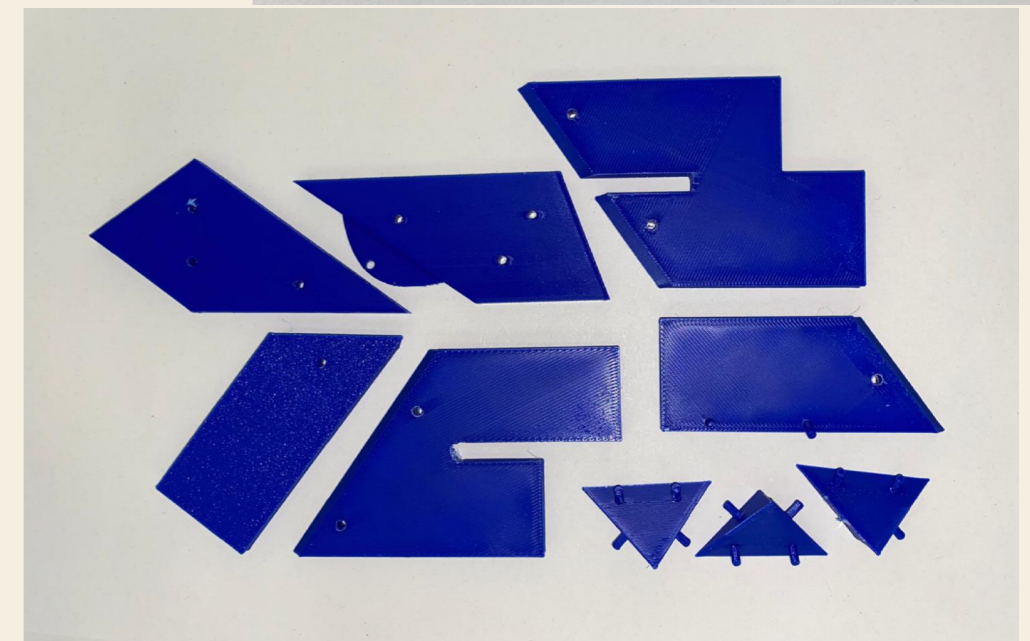
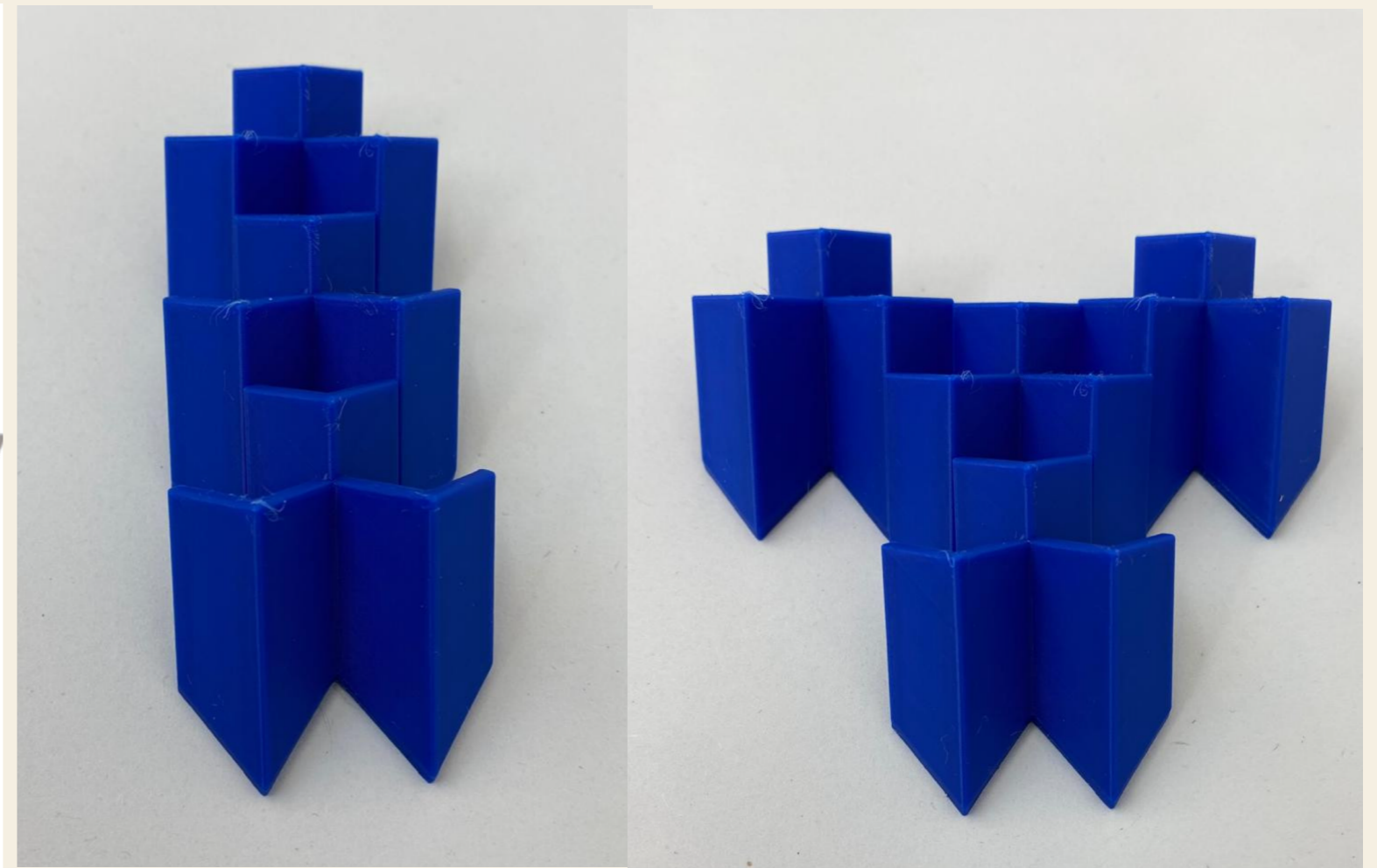
A wall-mounted wine rack will provide a seamless way to store bottles as finding ways to maximise space in confined apartments is a priority in design and is what customers want these days. After researching online and looking we find we have found a small gap in the market we want to look into..

Who would be interested?

- People who live in small homes or flats.
- Wine drinkers.
- People who would like to display their wine.
- Hospitality industry.
- home renovation specialists

Glasgow Wood 7 - Prototypes

6. We then created some physical prototypes with some cardboard then 3D printed from a CAD model.



I created these prototypes to get the general shape of a modular form. From all of these prototypes, we found that a modular design would work very well but we needed to make sure that we got the right dimensions for the wine bottle.

Glasgow Wood 8 - Presentation Slides

8. Interim Presentation Slides.

Ross Naphthine, Kai Porter, Tara Harcombe, Sam Jones, Findley Read

PROTOTYPE MODELS

Initial cardboard prototyping for design development
3D printed on a small scale to better understand the modular element of the design and for a more refined model.
Final prototype is made with wood to resemble the final product and show a possible manufacturing process.

TARGET MARKET

Wine Enthusiasts: Affluent collectors who value displaying and organising their wine collections.
Home Decor Enthusiasts: Young professionals and homeowners seeking stylish, space-saving decor.
Minimalists: Space-conscious consumers looking for functional, simple storage solutions.
Gift Shoppers: Individuals buying classy gifts for weddings, housewarmings, etc.
Hospitality Industry: Restaurants, bars, and boutique hotels seeking decorative wine storage.
Eco-Conscious Shoppers: Consumers who prefer sustainable, natural materials.

OUR QUESTIONS

- Would you recommend using other materials than scaffold?
- What price do you think a singular unit can be sold for.
- Do you think it should come in a one and people can buy multiply. Or a pack of 3 that could hold 9 wine bottles.
- Do you recommend using our biscuit joint we have created or screw our panels into the back plate.
- How would you recommend we wall mount it?

OUR DESIGN

MODULAR WALL MOUNTED BOTTLE RACK

- Holds 3 bottles per piece
- Individually fitted to the wall
- User can decide the placement of the pieces, creating a unique piece in their home
- Built for shorter-term wine storage.

SIZE & EASE OF BUILD

Thickness of product:
20 mm thickness
300mm length
Size of our product:
350 mm Width
233 mm Length
405 mm Height

Stencil:
Each piece could come with a printed stencil for a guide to help with ease of hanging

KEY DECISIONS

• Why did we choose this?
We were in between a Modular design or Dynamic design but settled on the Modular design

Mechanical or Static

Modular or Fixed

MATERIALS

Main Material
Designed using scaffold boards with biscuit or bolt joints holding the pieces together. Doing this there will be less cuts and less waste.
Biscuit joints would look cleaner on the front plate but could get away with screws at the back.
What would be best for Glasgow Wood?
Weight: 4kg
Weight (with bottles): 7kg
Screws: 1 screw per piece.
Material wastage: calculated at 60%

CONCEPT SKETCHES

WALL MOUNT OPTIONS

Frame hanging mount

Shelf hanging mount

Screw in mount

miro

Our interim presentation went well, although we felt we could have communicated our idea better, to allow Tom to see our vision of how fantastic the product is. The main takeaway was if it is wall-mounted it is necessary for the wine label to be on display. They also had never seen a vertical-style wall-mounted wine rack and were interested in making our design horizontal. They were pleased with the manufacturing elements although we had to change our biscuit joint and make it simple, but they were happy with the level of detail we went into.

Glasgow Wood 9 - CAD Models

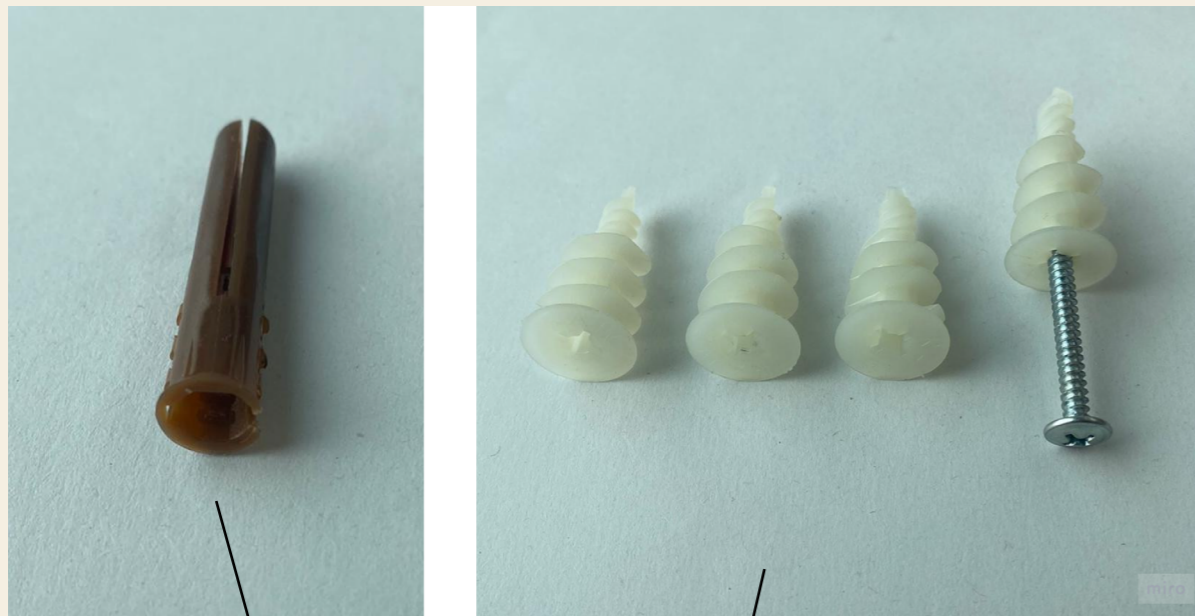
9. Here are the redesigns we came up with to allow you to see the label of the wine bottle.



We chose this design and also changing the biscuit joint to it being screwed into a back plate.

Glasgow Wood 10 - Product Details

10. Here are some details about our final design.

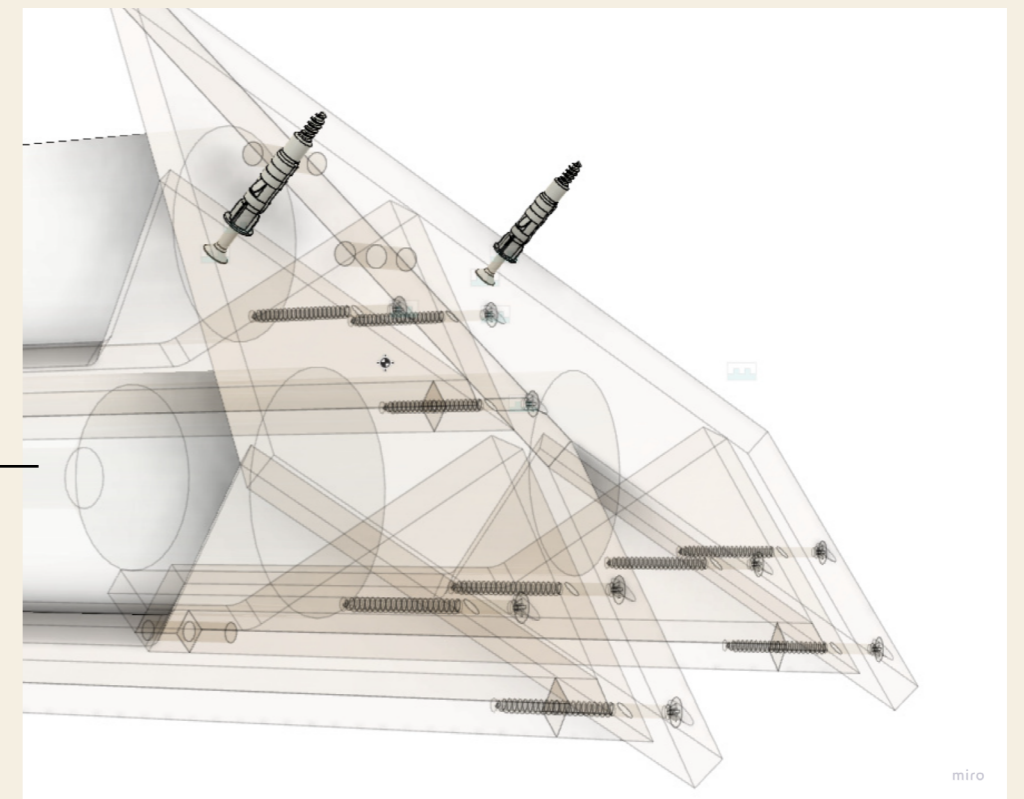


This is a wall fixing for a brick wall.

Here is the wall fixing for a gyprock wall.

- 3x screws for each holder
- 2 for the back-board which was changed to 4

55mm length - 4mm inner shaft diameter screws for holders



Through contact with Glasgow Wood, they would recommend Terra Osmo PolyX oil which is a dark oil finish.

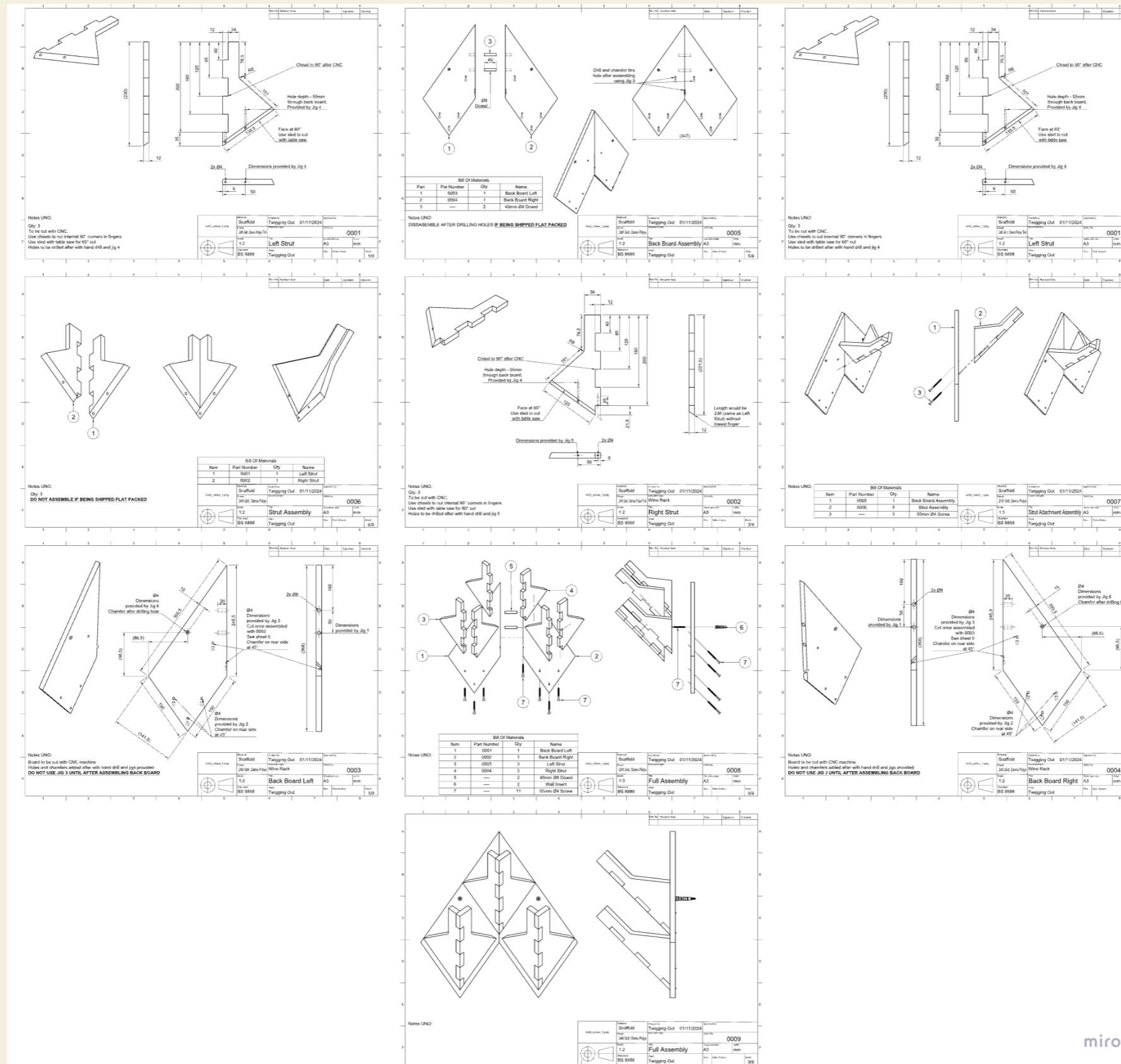
Glasgow Wood 11 - Final CAD Model

11. CAD model of the final deisgn.



Glasgow Wood 12 - Engineering Drawings

12. Engineering Drawings.



Glasgow Wood 13 - Product Details

13. We did a cost analysis and I created a wall template to scale for the user to use to help them drill the holes in their wall.

Rough Cost

2.5x hours of labour at £15.75 an hour -
£39.38

Vanishing cost 1/4 a tin at £11.50 - £2.88

Scaffold board cost £4 x 1/3 per one prod-
uct - £1.33

2x wall fixing pack of 40 for £5 - £0.25

11 screws - £0.11

2 dowels - £0.10

What sanding - 240 grit finish

What finish - dark oil tint

Labour cost breakdown:

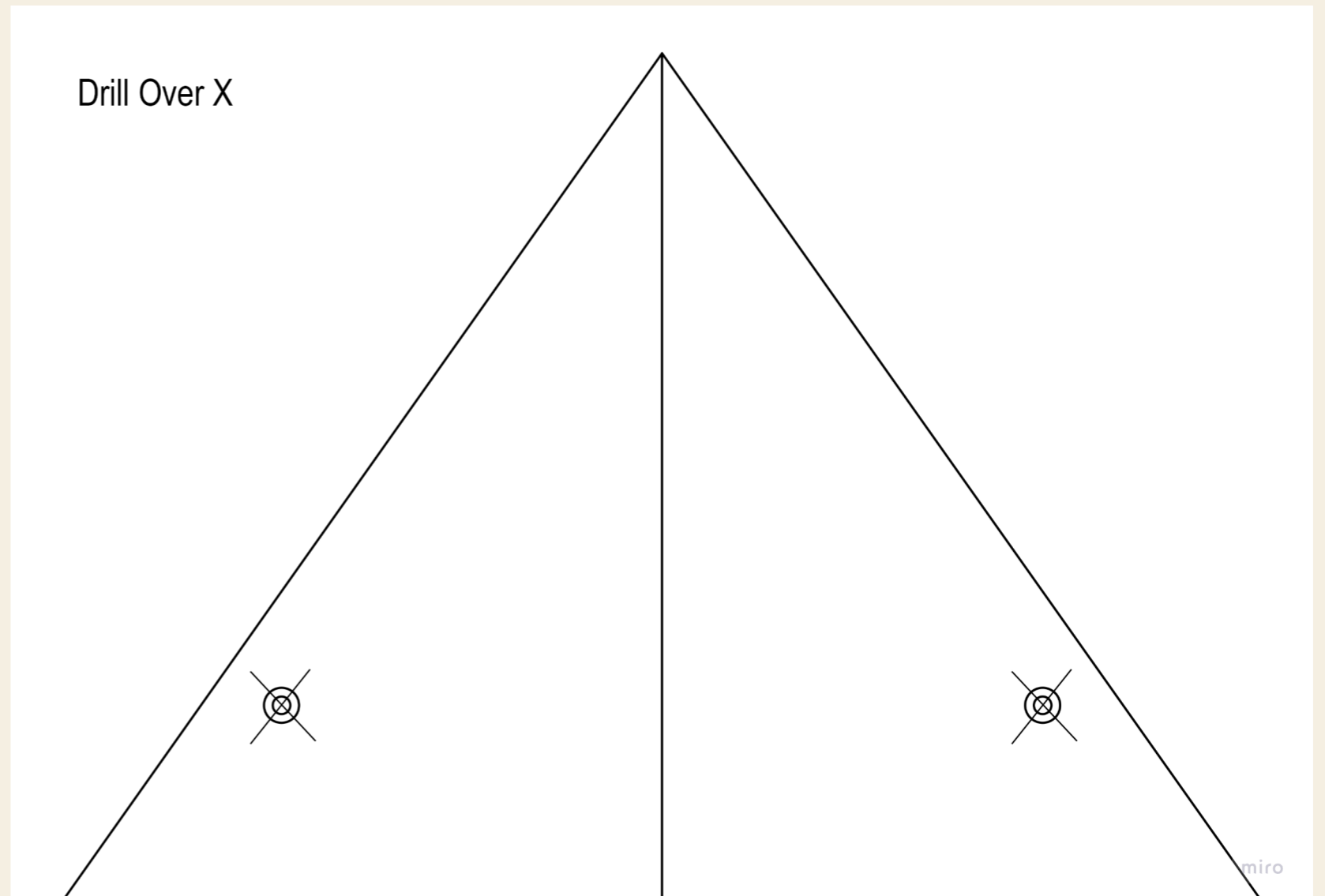
CNC does cutting no labour

Drilling with jigs

chiselling

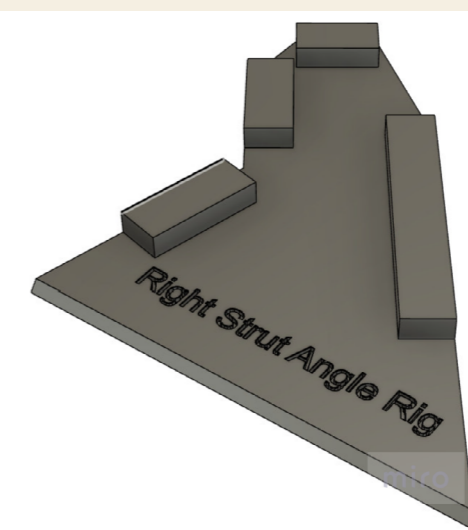
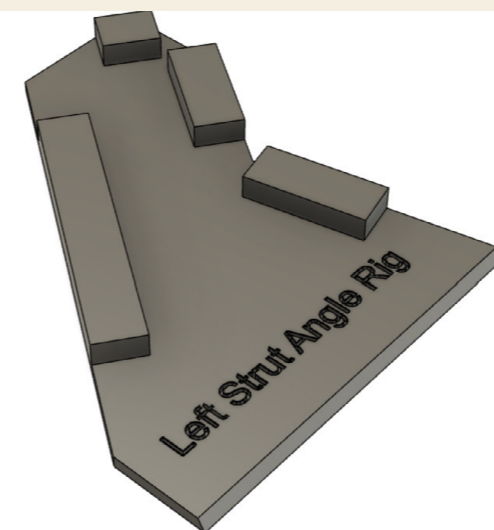
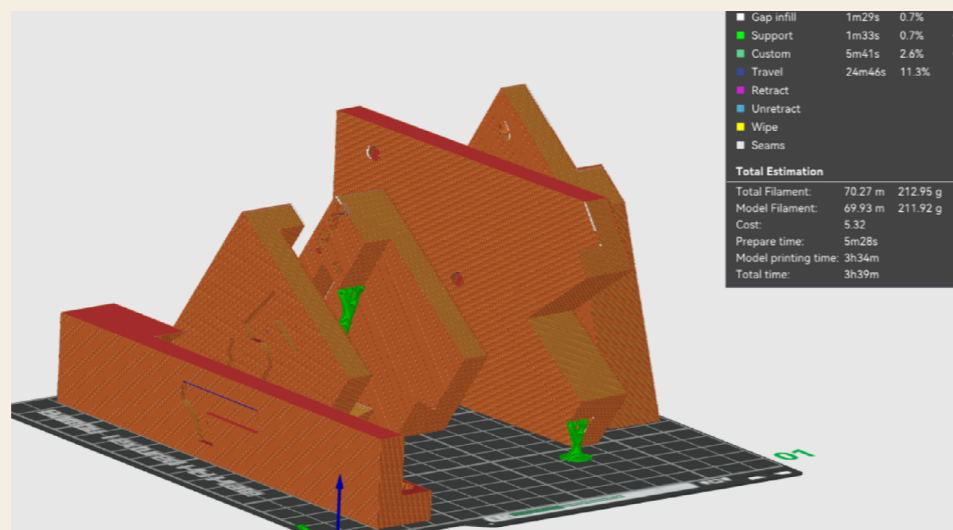
Sanding

Varnishing



Glasgow Wood 14 - Final Prototype

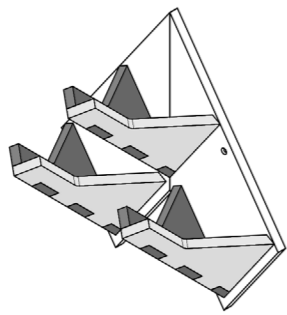
14. I then created a 1 to 1 scale of our final product, we then brought it to Glasgow Wood and got feedback from them. We also made some jigs for Glasgow Wood to use to help them build the wine rack. From the prototype, we learnt that the use of dowels was going to be too weak to support a full wine bottle and also due to how thin the wood is. We also found that the initial 2 screws to hold it in the wall weren't strong enough so we added 2 more.



Glasgow Wood 15 - Instruction Manual

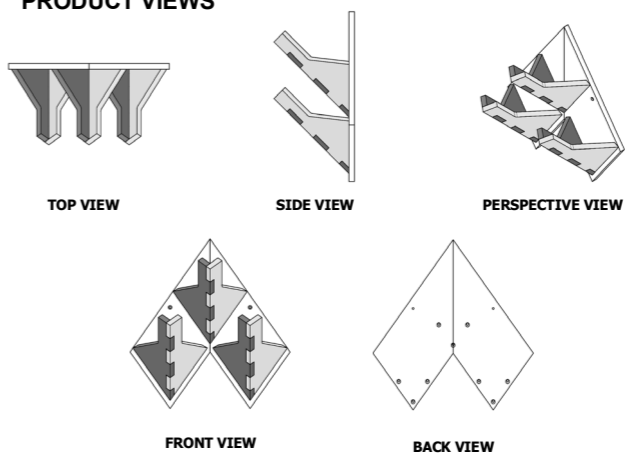
15. We then created the instruction manual, and I worked on the product views, parts list, tools list and cutting list.

Wine Rack




PLEASE REMEMBER NOT TO USE ANY TOOLS YOU HAVE NOT BEEN INDUCTED ON OR ARE NOT AUTHORISED TO USE.

PRODUCT VIEWS




PARTS LIST


(A) Back Board
2 no.




(B) Left Hold
3 no.




(C) Right Hold
3 no.




(D) Back Board Dowels
2 no.












(E) Flat Head Screw
11 no.



(F) Twist-Resistant Anchors
2 no.



TOOLS LIST


 Pencil	 Power Drill	 Sander & Extractor
 Tape measure	 P22 Driver Bit	 Wet Cloth & Gloves
 Set Square	 4mm Drill Bit	 Countersink Drill Bit


PPE
Please ensure you're wearing the correct PPE at all times

CUTTING LIST

COMPONENT	QUANTITY	LENGTH MM	WIDTH MM	THICKNESS MM	☑	NOTES
A Back board	2	~368	~173.5	12		Thin scaffold board
B Left Hold	3	230	~140	12		Thin scaffold board
C Right Hold	3	230	~140	12		Thin scaffold board
D Back Board Dowels	2	40	8	8		Dowel

HARDWARE


55 mm Screws
11 no.


Wall Insert
2 no.

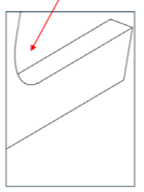
STEP BREAKDOWN FOR MANUFACTURING

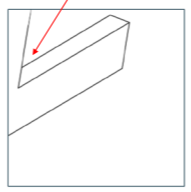
CHECK POINT

Ensure all components from machine shop are the correct sizes.
Refer back to parts list as necessary.
If you find a problem seek out a supervisor.

2 Chisel out the 90 Degree angle

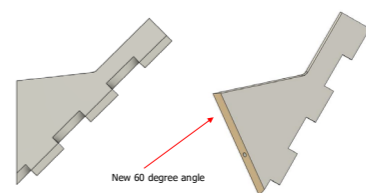
The CNC Machine can't make a clean 90-degree angles on the finger joints of the strut pieces, using a chisel, make this a right angle.
Use Chisel


Unchiselled


Chiselled

3 Cut 60 degree angle to the end of the strut piece using Sled

Use a table saw when cutting this angle




New 60 degree angle


1 Cut Basic shapes.

There should be 8 shapes in total
Use CNC Machine for this step


2x Back plate



3x Left Hold





3x Right Hold



4 Use jig 1 to cut dowel holes onto the central edge on back board.

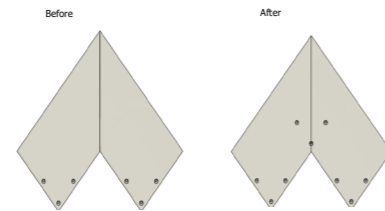
These dowel holes will be cut into the edge of the back board
Use a drill


Before

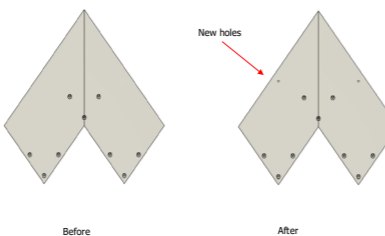

After

Glasgow Wood 16 - Instruction Manual

7 Use jig 3 to cut the higher set of angled holes onto the backboard
These are the holes that are in the centre of the backboard

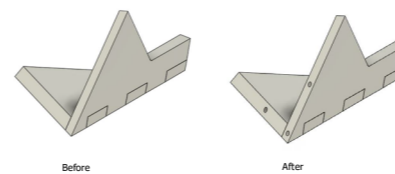


8 Use jig 6 to cut wall plate holes
These holes are used to screw the backboard into a wall.

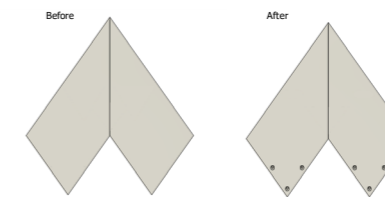


CHECK POINT
Ensure all holes are countersunk from the correct sides
Wall mounting holes should be countersunk from the opposite side to the strut mounting holes

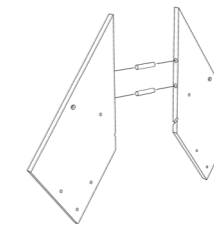
9 Use jig 4 and 5 to cut holes into the struts
Set the depth of your holes using jig 4 and use that same depth for jig 5
Drill



5 Use jig 2 to cut the lower two sets of angled holes onto the backboard
These are the holes that are at the bottom of the backboard



6 Assemble the backboard
Using dowels join the two pieces of the backboard.
Use dowels

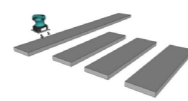


CHECK POINT
Check joints are secure and sturdy.
If you find a problem seek out a supervisor.

X Sand by hand with 240 grit.
Ensure to remove all sharp edges and prepare for finishing (if necessary).

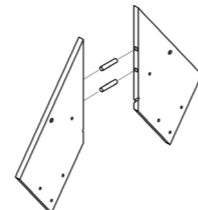
X Varnish product (exclude back of back plate) with Osmo PolyX oil colour Terra 3073
Ensure it is evenly coated

X You've finished!
Notify a staff member that the construction is complete and the item is ready for finishing.

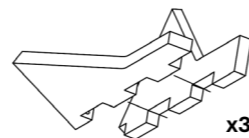


STEP BREAKDOWN FOR ASSEMBLY

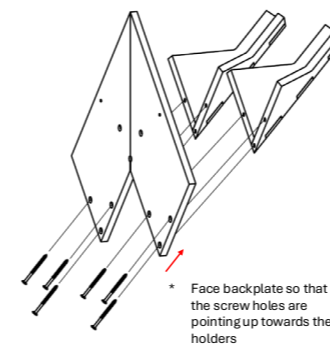
1 Join the back plates together with the dowels.



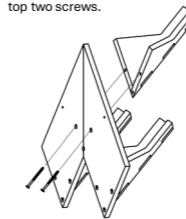
2 Join all the 6 holder parts to make 3 holders.



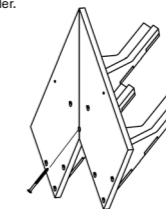
3 Screw the bottom 2 holders into the back plate.



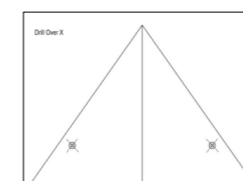
3 Screw the top holder into the back plate with the top two screws.



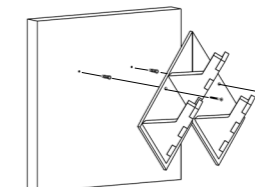
4 Screw the bottom screw into the top holder.



5 Drill into the wall through X points in stencil.



6 Put inserts into holes from step 5 and screw the back plate into the wall.



FINISHED EXAMPLE



Group Miro Link :

https://miro.com/welcomeonboard/TJZLQ3RTM1NLV0RkMmFuSmtBaGikNWRHSmduMUxhMERVM3NqYU5nMGpSVjh4UFFUODdXQVZTb0FyQk82RHpGd2pBbGoxbG1PYtdXcWJ3VndER1dyMStaSE44OEhKYWd1WEZqVHZpemxPNmFucGZyKzlaTEpWZZZDUHZSvkhQVUghZQ==?share_link_id=444388346162

Glasgow Wood 17 - Final Poster

16. This is the final poster we made, I helped make the render and I edited the the main image with the wine rack on it.



Overall, I am very happy with how the final product came out. I think it has developed well from the initial ideas of the wine rack which were all quite traditional to creating a modular wine rack that could be used in a kitchen at home and places like restaurants and bars. I think it still could've been done to make it easier to manufacture as even with the jigs and all the different angles it makes it hard to make. I also think if we were able to make it more customisable like being able to change how the actual is help, for example, if you wanted it horizontal or vertical. But I am happy we decided to create something different to what Glasgow Wood currently create.

Product Specifications



Materials:
Scaffold Board, Wood Screws,
Osmo Polyx Tint Finish

Life Cycle
10+ years, wood can be
recycled into chipboard,
screws are reusable.

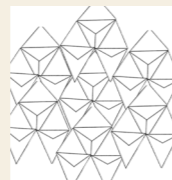
Size
350mm x 230mm x 140mm

Key Function
Holds three Wine Bottles and
displays labels in an aesthetic
way

Cost
£45 Manufacture, £60 Retail

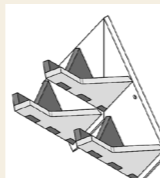
Aesthetics
Modular, Innovative, Wooden,
Reclaimed

Development Process



Discover: Ideation and
concept development
phase with a broad
scope of what we could
design from wood.

Define: By prototyping
with cardboard and
3D-printed CAD
models, we could see
what designs would
work.



Develop: This included
a redesign of our
initial design based
on feedback given by
Glasgow Wood.

Deliver: Creating
our finalized CAD,
producing engineering
drawings, and an in-
depth assembly guide.

Fix-a-Friend 1 - Initial Product/Issue

GrowMore

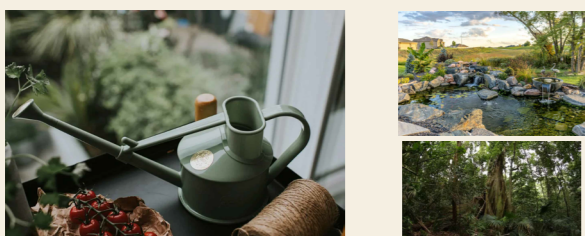
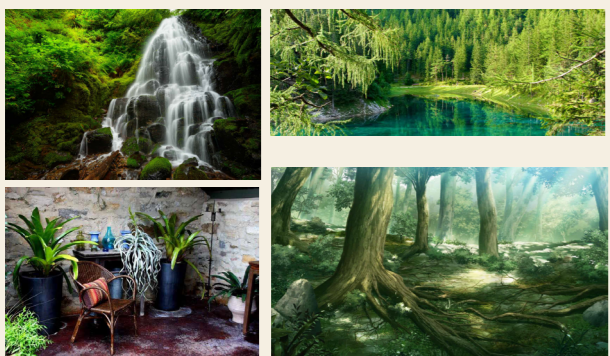
Harrington Font -
Heading/Logo Text
Perpetua - Body Text



Colours

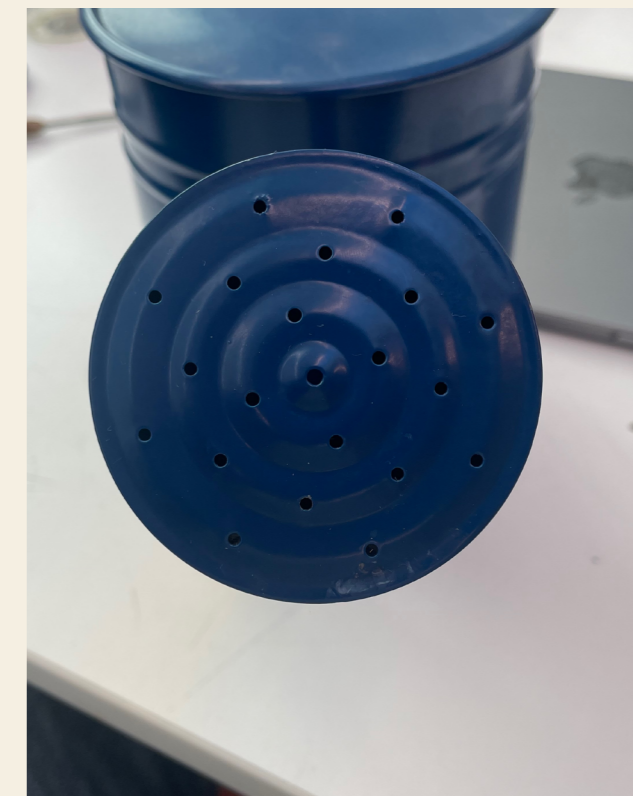


This was the brand package that I was given by my client.



The purpose of this project was to redesign a product that your client finds annoying to use but still uses it, and to make it better to the client's needs. My client was a classmate of mine called Sam.

Here are some photos of the original product that I was given by my client to redesign and fix.



Fix-a-Friend 2 - Initial Ideas and PDS

	Replaceable File	Watering Can
Likes	<ul style="list-style-type: none"> - Shape of handle - File is replaceable 	<ul style="list-style-type: none"> - General size - Cheap - Metal - Length of spout
Dislikes	<ul style="list-style-type: none"> - How loose the file is - Shape of the file - Short handle 	<ul style="list-style-type: none"> - Not comfortable handle - Too wide of a spout - Too much tilt is needed - Water trapped in spout - General form
Like to change	<ul style="list-style-type: none"> - Handle grip design - Indication of when file is securely attached 	<ul style="list-style-type: none"> - Sleeker design - Ergonomic handle - Detachable nozzle - Spout higher than watering can
Other info	<ul style="list-style-type: none"> - Uses once a week - Helps remove excess material from 3D prints - Borrowed from dad 	<ul style="list-style-type: none"> - Used twice a week - Used to water plants - Only watering can he could find

Product Design Specification

Product Overview

A household watering can be designed for indoor plant care, combining ergonomics, aesthetics, and functionality to enhance user experience.

Performance Requirement

- It must hold between 1.5L and 3L of water for easy household use.
- Ensures a smooth and consistent water flow with minimal effort.
- It should prevent spillage when carried or tilted at moderate angles.
- Designed for efficient water usage with minimal waste.
- The spout must be positioned higher than the top of the can

Materials & Durability

- Made from lightweight and durable materials
- It must be corrosion-resistant for long-term usability.
- It must be made from a metal

Ergonomics & User Interaction

- Comfortable, easy-grip handle to accommodate various hand sizes.
- Well-balanced for controlled pouring, even when full.
- Detachable or adjustable spout for versatile watering options

Safety

- Leak-proof design to prevent water spillage.
- Non-toxic materials for user and plant safety.
- Smooth edges to prevent hand injuries.

Aesthetic & Design Features

- Modern, minimalist, and visually appealing design.
- Available in various colours to complement different home styles.

Cost & Market

- Retail prices to be competitive within the household gardening market.
- Suitable for budget-conscious consumers while maintaining quality.
- £10 or less

Maintenance & Cleaning

- Easy to clean with a removable spout or wide opening for accessibility.
- Resistant to mould and algae growth with smooth interior surfaces.

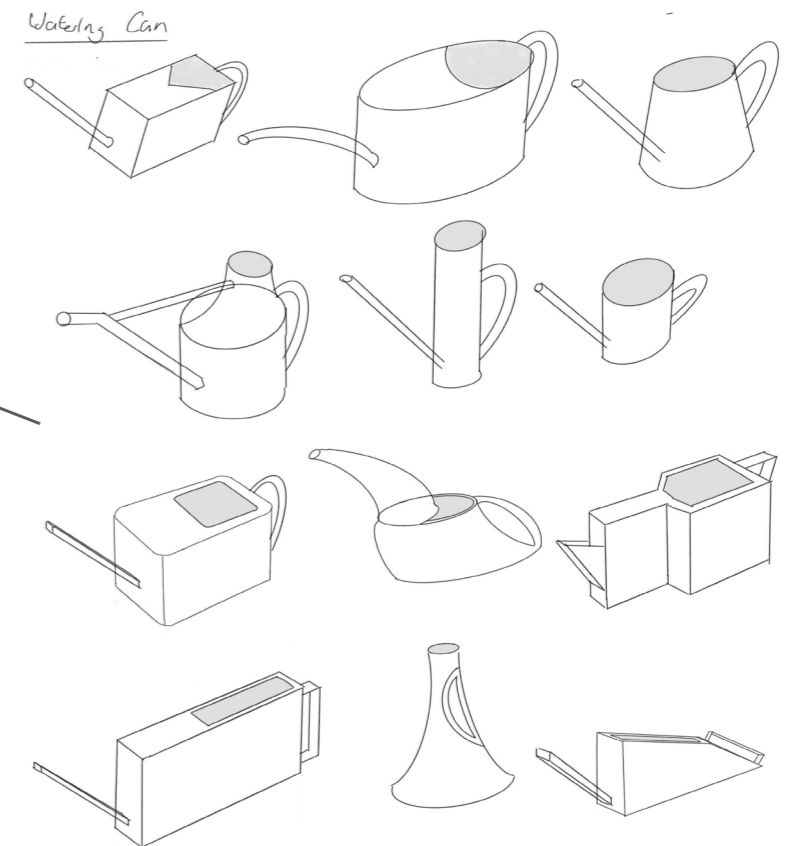
Watering Can

2. Then I have made a PDS for the watering can including everything I need and to be thinking about when designing the product.

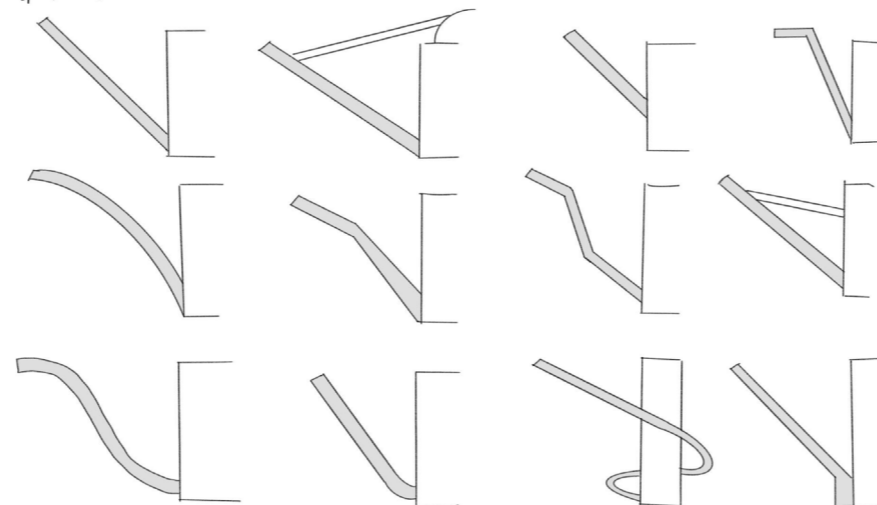
1. So I first started off asking different questions about the replaceable file and the watering can. Finding out what he likes and dislikes and what he would want to change.

3. I then started sketching some general shapes of what water cans I have come up and I am planning to ask my client on 3 he prefers and what I could change.

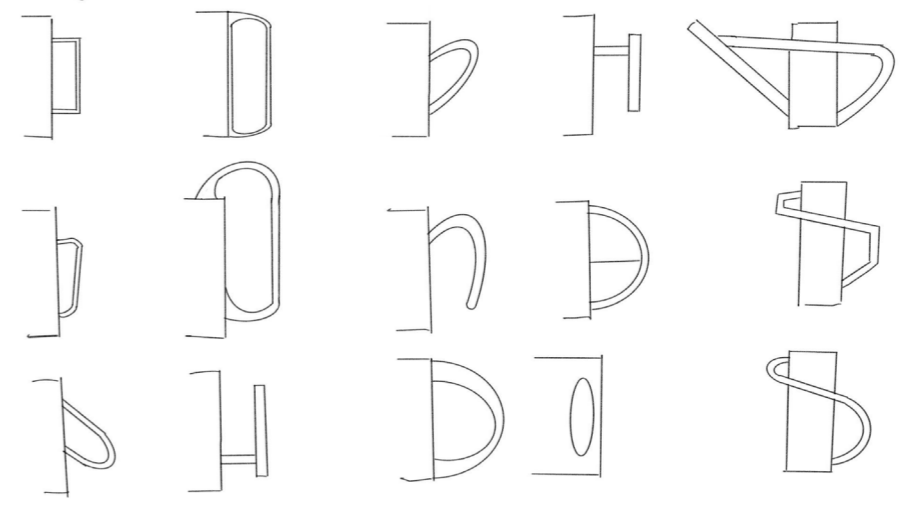
4. I have also come up with some general designs of handle and spout shapes. I am going to go back to the client and ask him what his 3 favourites are for each and go from there.



Spout Design

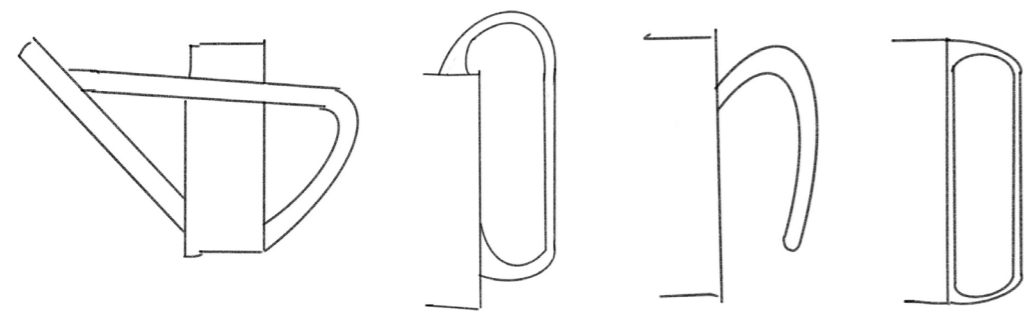
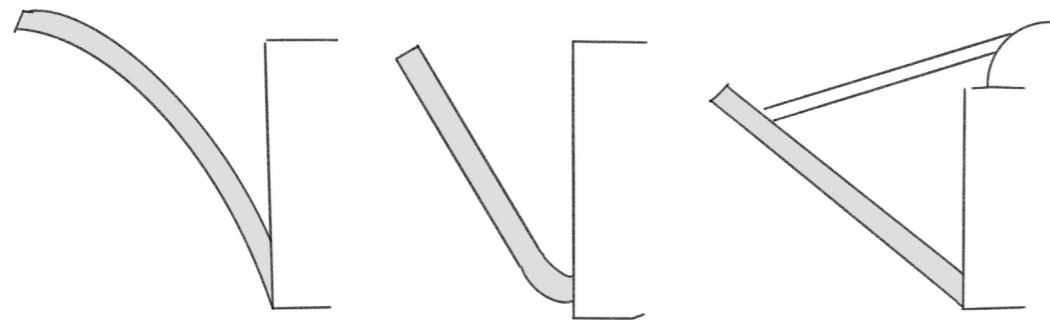


Handle Design



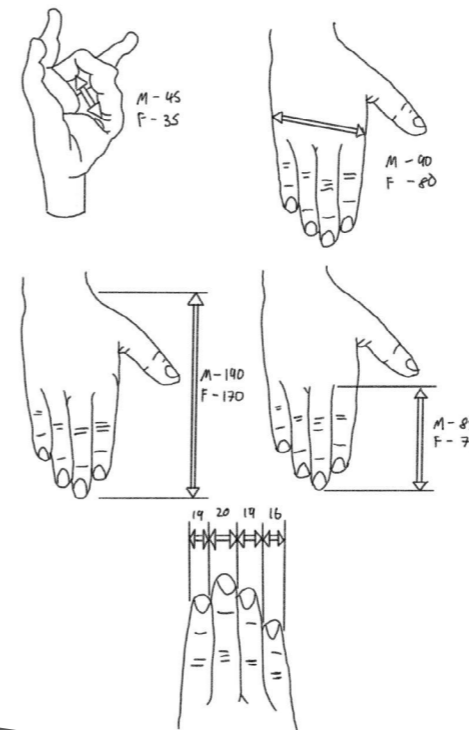
As you can see here are my weekly progress sheets of what work I was doing and explaining my thinking throughout the project.

Fix-a-Friend 3 - Development



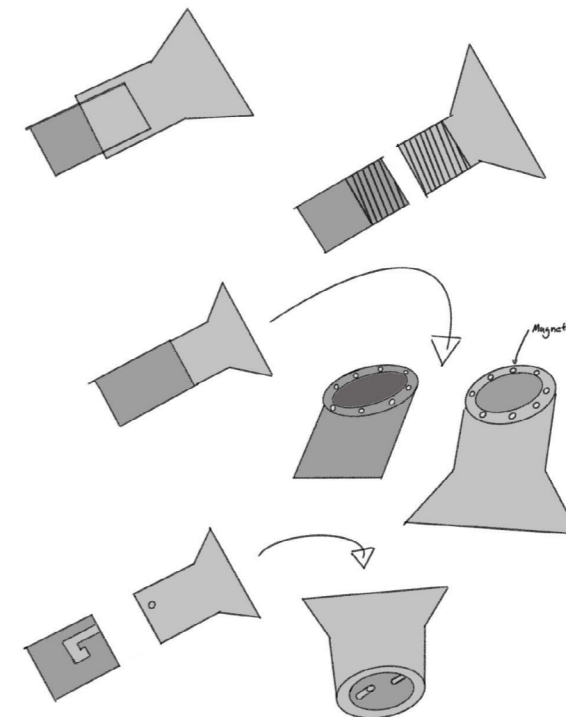
2. I then looked into the anthropometrics of the hand for the handle and looked into different type of ways I could be able to attach a nozzle to the spout

Anthropometrie



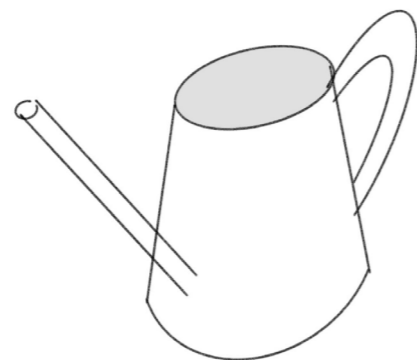
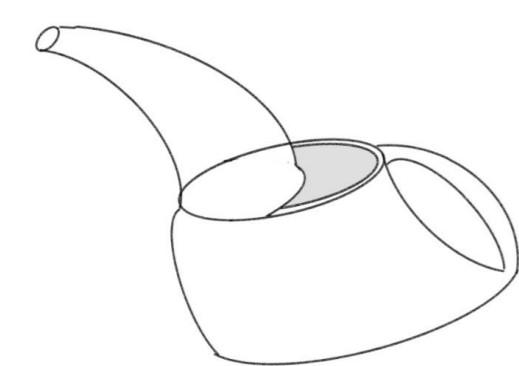
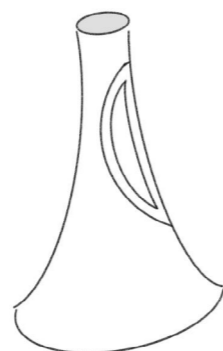
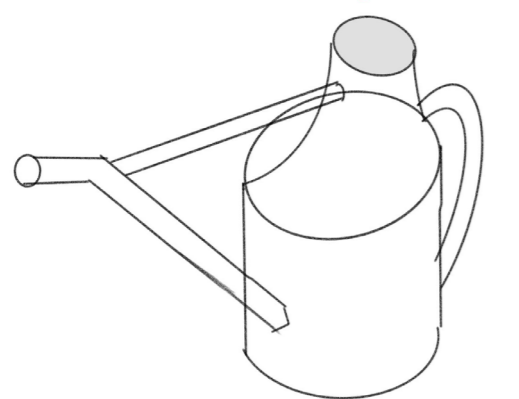
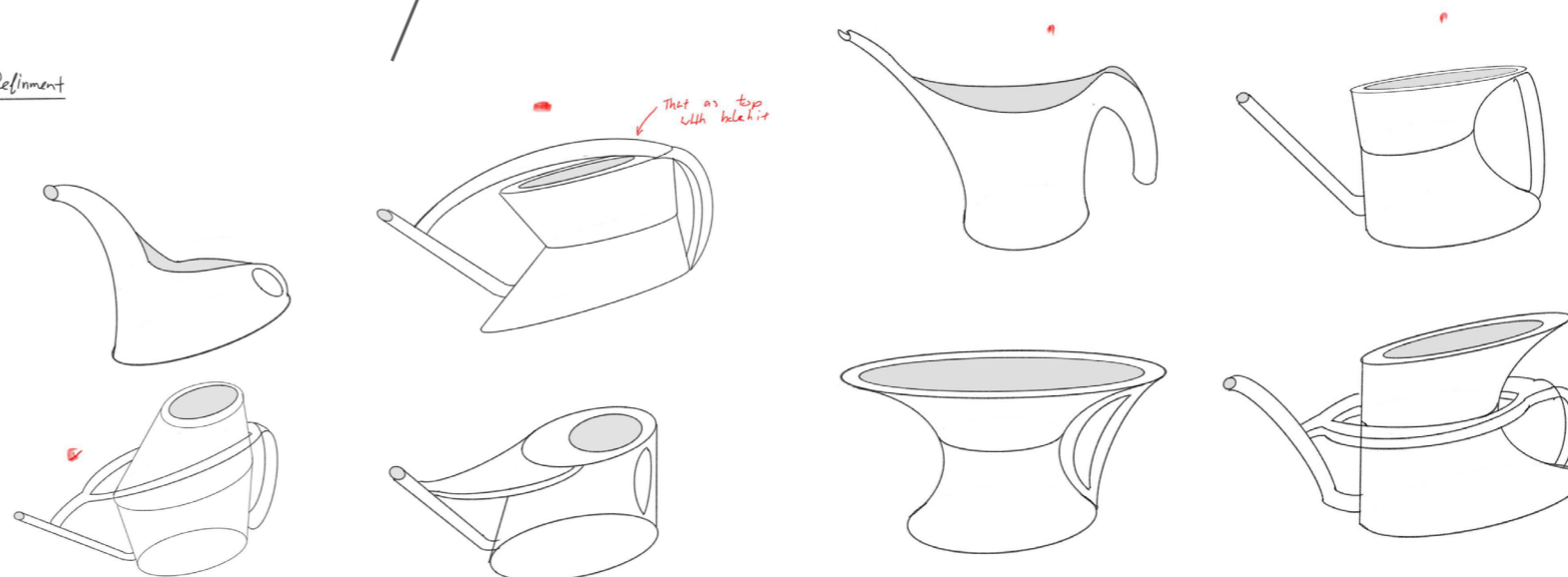
1. So I started off by going to my client and asking them which of the different designs he likes. The ones here are the ones he chose.

Detachable Nozzle

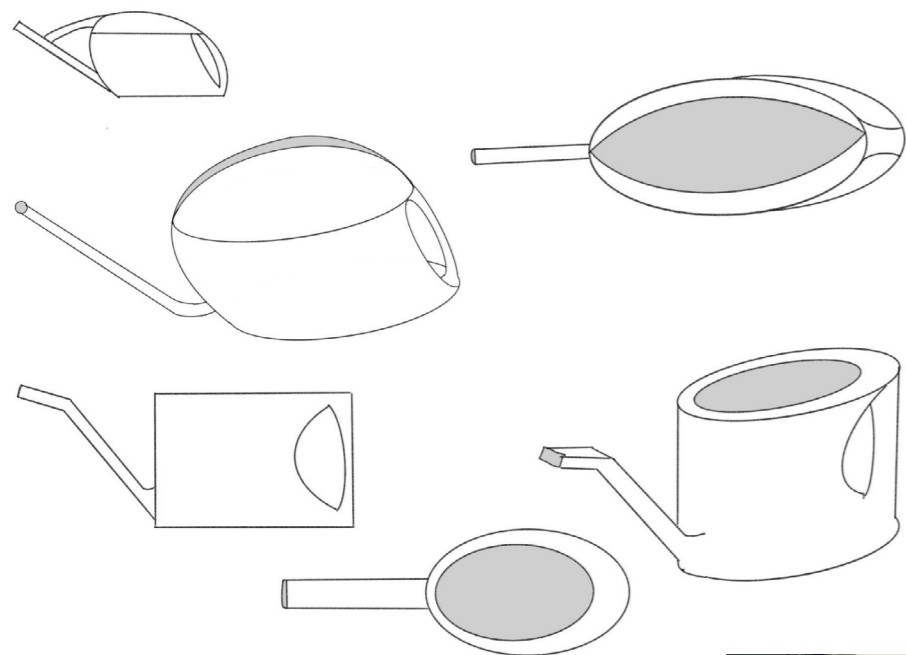


3. From the chosen designs my client liked I started off designing some watering cans with in mind of the type of features he liked. The ones with the red dots are the ones he likes from my refined designs.

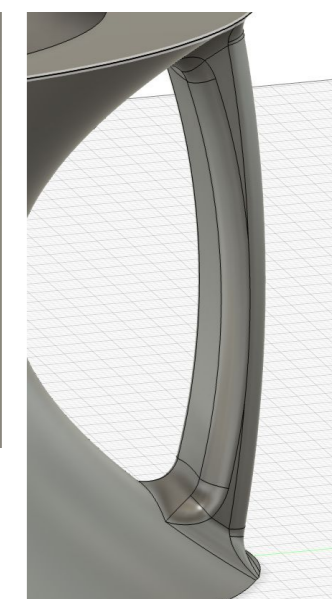
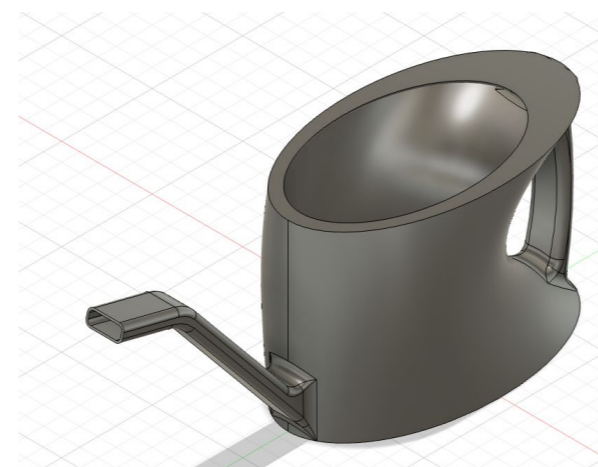
Refinement



Fix-a-Friend 4



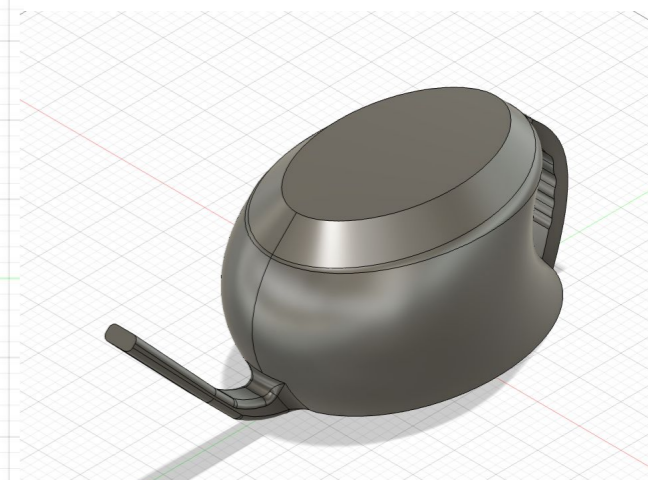
1. Here I did some sketches of the 2 final designs I chose.



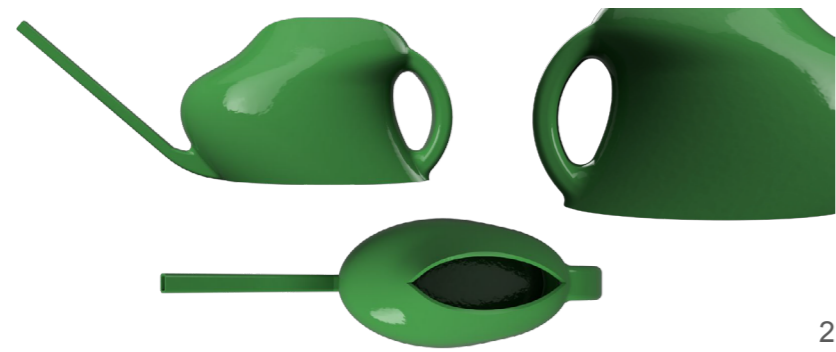
4. I create a foam model of the handle size I will be implementing and asked the client if it is comfortable and the right size.

2. I then created them in CAD Just to get an idea of their form, I asked my client which one he preferred and he chose the one below.

3. So I am going to print a scale version of it but of a newer design. And then I am going to make a foam model to scale.



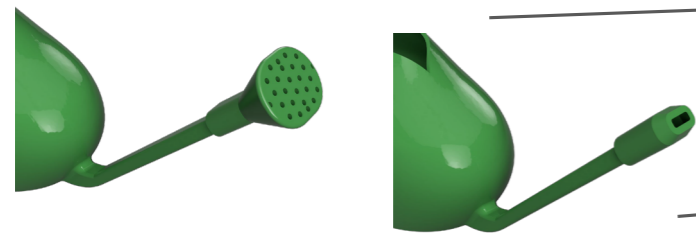
Fix-a-Friend 5



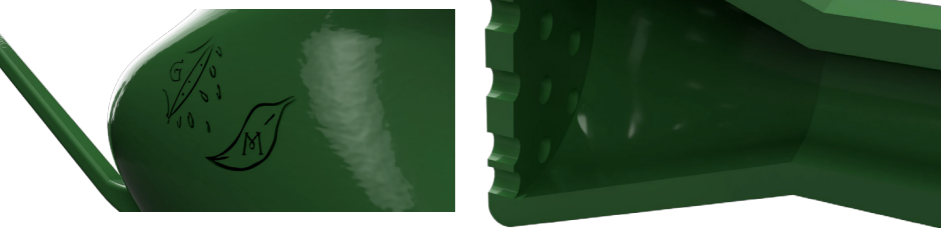
1. Started off creating a final CAD model of the one the client liked. With some changes of the opening.



2. I also designed 2 different detachable nozzles that has a tight tolerance to it comes off good but still stays on in use.



6. I did some final renders of it in a actual environment for my poster

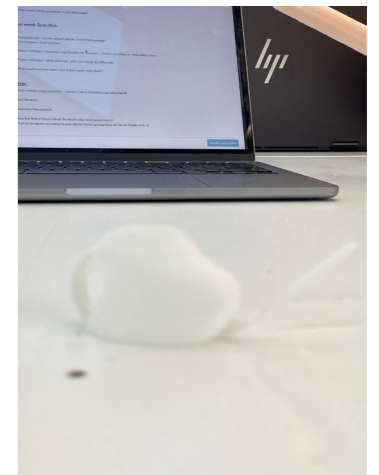


3. Added the company's logo embroidered on the side of the can.

5. I also printed a 3D printed model on a smaller scale. Just to the actual form of it.

7. I also found the volume of the watering can which is 1.63 litres of water.

4. I then created a foam model to scale to get a feeling of the size, and tried my best to recreate the right handle size.



Fix-a-Friend 6

Client review / final feedback

Looks great :) Looks functional and holds a good amount of water. I like that you put the logo on the side of the can a better place might be above the handle so it will be in the users line of sight. Shape of the nozzle could still be more circular but that's it really. The final product fits the brief/fixes the issues I brought up in the 1st week.

Project reflection - what went well, what you would do differently

I think that i explored a lot of different types of initial designs and kept the client involved the whole time asking his opinions and thoughts on most stages. I also think the 3 different prototypes really helped me as well. Also having the 2 different detachable nozzles is very helpful. I think I kept the sleek and aesthetic mind throughout the design.

I think what I would've done differently is to do a bit more of a complex design or project. Like adding in a mechanical function or something like that. I think I could've tried to make a full scale version of the watering can which would've been very helpful. Also implementing a adjustable flow design or detachable handles.

Project summary - overview + justification for direction - connect summary to initial project aims

The aim of the project was to solve the issues from the client of a product. The main issues were the uncomfortable handle, nozzle catching water, excessive tilting needed and the overall form. So I added in a ergonomic handle, 2 detachable nozzles, fixed the water catching, increased the height of the spout and made a sleeker design. I chose 5052 aluminum was chosen for its corrosion resistance and strength whilst also being easy to manufacture with the process of deep drawing manufacturing.

What *would* you have done next if there were more time?

I think I could've done a bit more refinement of the design, also adding a mechanical feature. I could've also added some sort of other feature so it could be multi use. Doing some material tests to see how well 5052 aluminum would work. Created full scale prototypes to get user feedback on.

Fix-a-Friend 7

This was my final poster for this project.

Overall, I am happy with how the final project came out but as you can see by the client's review there could be some changes done to their preference. I think I could've added some sort of mechanism into it, it also would've been nice if I made a fully functional scale model to test everything.

GrowMore



Original Product



Likes

- Size
- Cheap
- Metal
- Length of spout

Dislikes

- Uncomfortable handle
- Too wide of spout
- Too much tilt needed
- Water trapped in spout
- Overall form

I designed two detachable nozzles with precise tolerances, ensuring they can securely attach to the spout while remaining easy to slide on and off. The first nozzle provides a wider water spread, while the second delivers a more concentrated flow.



What to be developed

- Sleeker design
- Ergonomic handle
- Detachable nozzle
- Spout need to be higher than the can
- Better nozzle design



I researched anthropometric data for handles and created a prototype to test with the client, who was pleased with the design. I then incorporated the finalised design into my CAD model, ensuring accurate dimensions.



To resolve the issue of water getting trapped at the bottom of the widespread nozzle, I have incorporated a drainage hole to allow any residual water to flow out efficiently.



In my design, I incorporated an engraved logo on one side of the watering can. I chose not to engrave both sides, as I felt it would compromise the sleek aesthetic of the design.



I designed the opening to be large enough for easy hand access during cleaning while also shaping it to resemble a leaf, aligning with the client's theme and design brief.



Here is a photo of the solid volume of the watering can, which equates to a water capacity of 1.63 litres.



Material

5052 Aluminum

- Highly corrosion-resistant (great for water exposure)
- Strong yet flexible, making it easy to shape
- Good weldability if you're joining parts together

Manufacturing

Deep Drawing

- Uses a metal die and punch to shape aluminum into a deep, seamless form
- Ideal for smooth, rounded shapes
- Would require a custom die, so better for large-scale production

Kai Porter